CLAIMS

WHAT IS CLAIMED IS:

1. An excimer laser system comprising:

A) a laser chamber containing:

1) two spaced apart elongated electrodes;

2) a laser gas comprising:

at least one noble gas and fluorine,

3) two window housings each housing a window,

B) a blower for flowing the laser gas between the two spaced apart electrodes;

C) a fluorine source;

D) a metal fluoride trap;

E) a fluorine monitor comprising an absorption cell and a light source for producing light in said absorption cell in a spectral range of relatively high absorption in F_2 gas,

F) a gas sampling circulation system for extracting a first small portion of said laser gas downstream of said blower directing said small portion to said metal fluoride and then directing all or a second portion of said first small portion through said sample cell and then to one of said window housings;

G) a fluorine control system to regulate the concentration of fluorine gas in said laser chamber based on signals from said fluorine washer.

2. An excimer laser system as in Claim 1 wherein said light source is an ultraviolet light source.

3. An excimer laser system as in Claim 2 wherein said monitor further comprises a light detector and an optical system to direct a portion of ultraviolet light from said light source through said absorption cell to said light detector.

4. An excimer laser system as in Claim 3 wherein said fluorine monitor also comprises a reference cell.

5. An excimer laser system as in Claim 1 wherein said fluorine monitor also comprises a filter device comprising a plurality of filters and a means for successively placing each filter in said plurality of filters in said beam of ultraviolet lights.

6. An excimer laser system as in Claim 1 wherein said excimer laser system is a KrF laser system and said at least one noble gas is krypton and also comprising neon as a buffer gas.

7. An excimer laser system as in Claim 1 wherein said excimer laser system is an ArF laser system and said at least one noble gas is argon and also comprising neon as a buffer gas.

8. An excimer laser system as in Claim 1 wherein said excimer laser system is an F_2 laser system.

9. An excimer laser system as in Claim 1 wherein said fluorine control system comprises temperature and pressure sensors and a processor programmed to adjust fluorine injection based on temperature deviations from a reference temperature.

10. An excimer laser system as in Claim 1 wherein said laser feedback control system is programmed to control fluorine flow to keep said laser operating within a predetermined sweet spot.

11. An excimer laser system as in Claim 10 wherein sweet spot is defined as a range of fluorine concentration.

12. An excimer laser system as in Claim 10 wherein said sweet spot is defined by a slope of a voltage vs. F_2 concentration curve.

13. An excimer laser system as in Claim 12 wherein said fluorine control system is programmed to inject fluorine at intervals close enough together to simulate continuous injection in order to permit a voltage defined sweet spot no larger than about 2 percent of the nominal sweet spot voltage.

14. An excimer laser system as in Claim 1 wherein said fluorine source is a source of substantially 100% fluorine.

15. An excimer laser system as in Claim 1 wherein said feedback fluorine control system is programmed to increase the chamber gas pressure as the chamber ages.

16. An excimer laser system as in Claim 2 wherein said fluorine monitor is an acoustic monitor and comprises a pulse light source at least a portion of which is within a spectral range of relatively high absorption in F_2 gas, and further comprises a microphone for monitoring acoustic waves in said absorption cell.

17. An excimer laser system as in Claim 16 wherein said absorption cell is configured to establish at least one acoustic standing wave.

18. An excimer laser system as in Claim 17 wherein said absorption cell comprises an entrance port and an exit port located at node locations of said at least one standing wave.

19. An excimer laser system as in Claim 18 wherein said absorption cell comprises two windows to permit entrance and exit of light from said pulse light source wherein each of said two windows are located at a node location of said at least one standing wave.

20. An excimer laser system as in Claim 18 wherein said absorption cell comprises a cylindrical internal cavity defining an axis and further comprises two windows positioned on said axis.

21. An excimer laser system as in Claim 20 wherein said absorption cell also comprises two buffer cavities.

22. An excimer laser system comprising:

A) a laser chamber containing:
   1) two spaced apart elongated electrodes;
   2) a laser gas comprising:
      at least one noble gas and fluorine,
   3) two window housings each housing a window,

B) a blower for flowing the laser gas between the two spaced apart electrodes;

C) a fluorine source;

D) a metal fluoride trap;

E) a fluorine monitor comprising an absorption cell and a light source for producing light in said absorption cell in a spectral range of relatively high absorption in F_2 gas,

F) a gas sampling circulation system for extracting a first small portion of said laser from said laser chamber and directing said small portion through said sample cell;

G) a fluorine control system to regulate the concentration of fluorine gas in said laser chamber based on signals from said fluorine washer.

23. An excimer laser system as in Claim 1 wherein said light source is an ultraviolet light source.

24. An excimer laser system as in Claim 22 wherein said excimer laser system is a KrF laser system and said at least one noble gas is krypton and also comprising neon as a buffer gas.

25. An excimer laser system as in Claim 22 wherein said excimer laser system is an ArF laser system and said at least one noble gas is argon and also comprising neon as a buffer gas.

26. An excimer laser system as in Claim 22 wherein said excimer laser system is an F_2 laser.

27. An excimer laser system as in Claim 22 wherein said fluorine control system comprises temperature and pressure sensors and a processor programmed to adjust fluorine injection based on temperature deviations from a reference temperature.

28. An excimer laser system as in Claim 1 wherein said fluorine control system is programmed to control fluorine flow to keep said laser operating within a predetermined sweet spot.

29. An excimer laser system as in Claim 28 wherein sweet spot is defined as a range of fluorine concentration.

30. An excimer laser system as in Claim 28 wherein said sweet spot is defined by a slope of a voltage vs. F_2 concentration curve.

31. An excimer laser system as in Claim 12 wherein said fluorine control system is programmed to inject fluorine at intervals close enough together to simulate continuous injection in order to permit a voltage defined sweet spot no larger than about 2 percent of the nominal sweet spot voltage.

32.. An excimer laser system as in Claim 22 wherein said fluorine source is a source of substantially 100% fluorine.

33. An excimer laser system as in Claim 22 wherein said feedback fluorine control system is programmed to increase the chamber gas pressure as the chamber ages.

34. An excimer laser system as in Claim 22 wherein said fluorine monitor is an acoustic monitor and comprises a pulse light source at least a portion of which is within a spectral range of relatively high absorption in F_2 gas, and further comprises a microphone for monitoring acoustic waves in said absorption cell.

35. An excimer laser system as in Claim 34 wherein said absorption cell is configured to establish at least one acoustic standing wave.

36. An excimer laser system as in Claim 35 wherein said absorption cell comprises an entrance port and an exit port located at node locations of said at least one standing wave.

37. An excimer laser system as in Claim 36 wherein said absorption cell comprises two windows to permit entrance and exit of light from said pulse light source wherein each of said two windows are located at a node location of said at least one standing wave.

38. An excimer laser system as in Claim 37 wherein said absorption cell comprises a cylindrical internal cavity defining an axis and further comprises two windows positioned on said axis.

39. An excimer laser system as in Claim 38 wherein said absorption cell also comprises two buffer cavities.